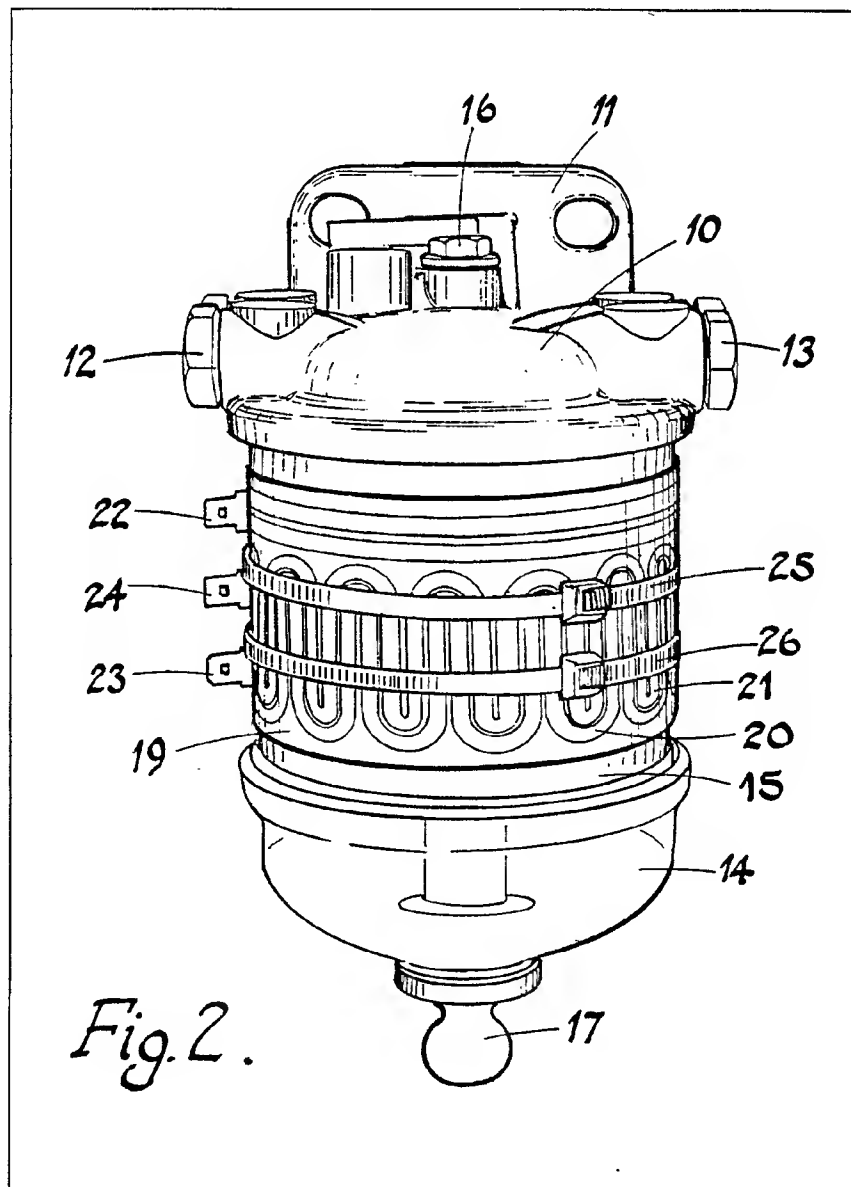


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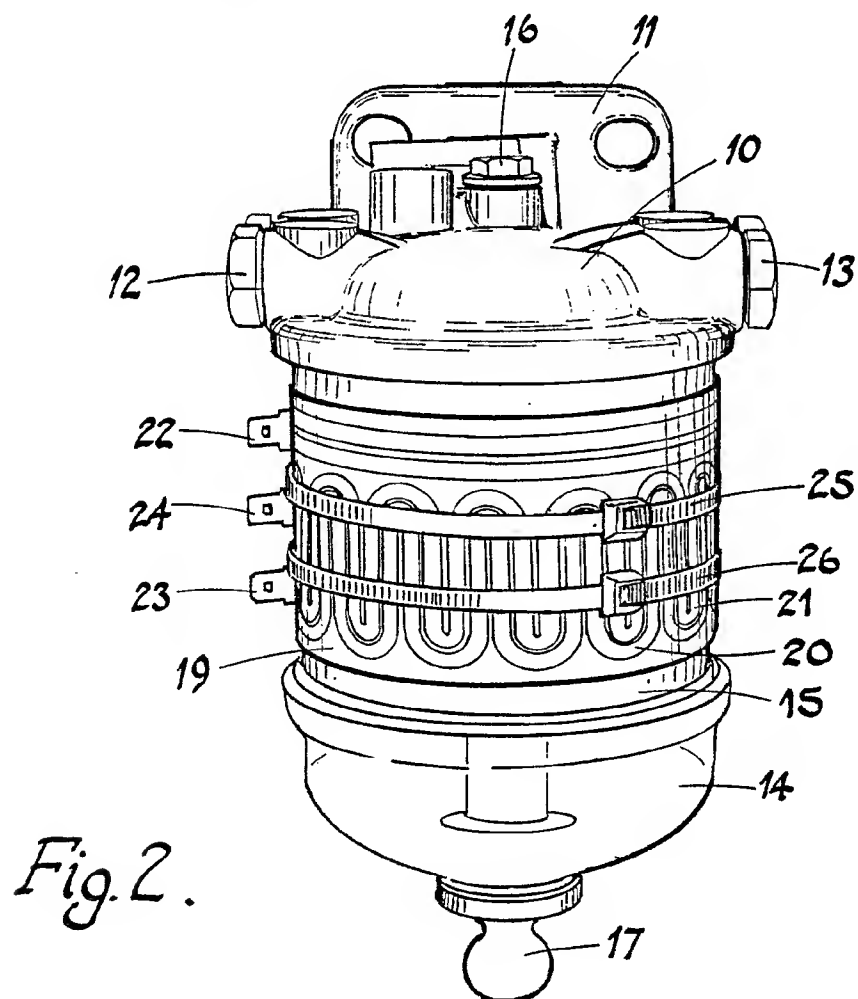
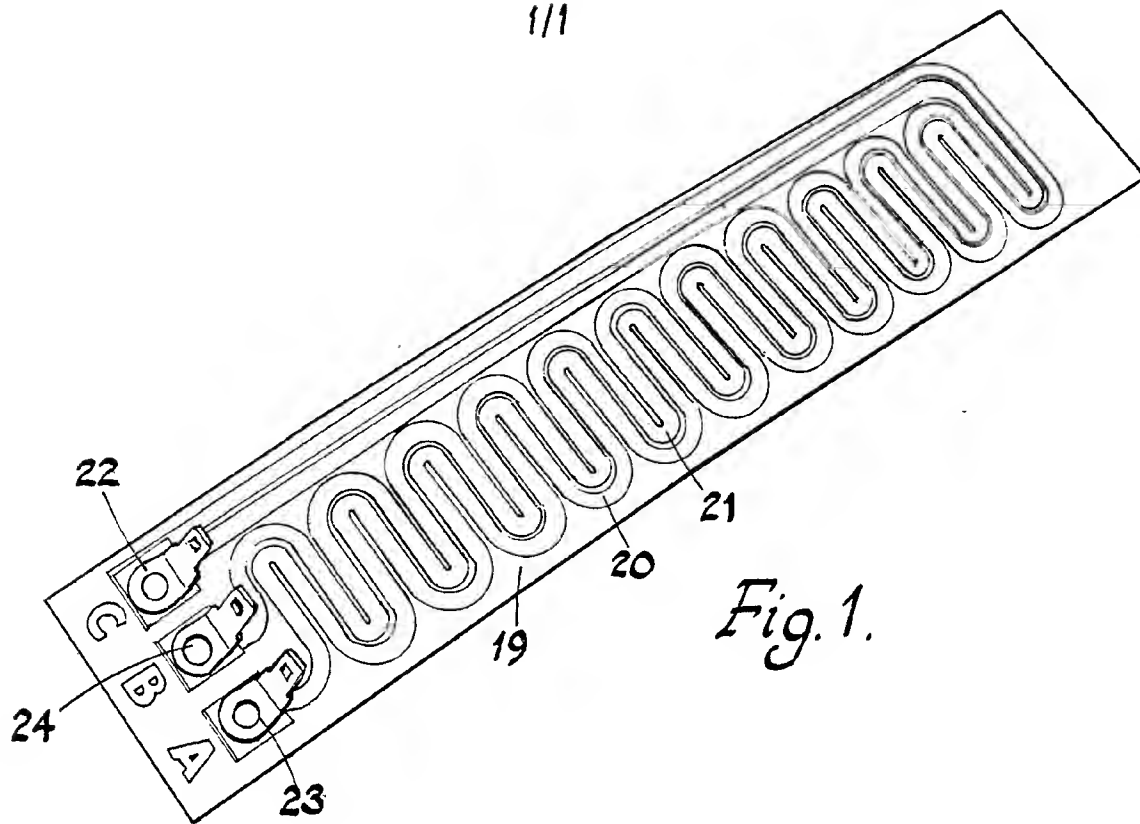
(54) Means for counteracting the  
effects of low temperatures on liquids

(57) Means for counteracting the

effects of low temperatures on liquids  
such as fuel flowing through a fuel filter.  
10, 14, 15, comprising a base 19 on  
which is provided an electrical printed  
resistance heater 20, 21, the heating  
means being secured around the filter  
element 15 by straps 25, 26, the heating  
means being alternatively used on a  
fuel tank or engine oil sump and being  
securable thereonto by adhesive.



1/1



## SPECIFICATION

**Means for counteracting the effects of low temperatures on liquids**

5 This invention is concerned with means for counteracting the effects of low temperatures on liquids, for example on the supply of liquid fuel for internal combustion engines or for keeping liquid sufficiently  
10 warm to prevent freezing.

It is well known that at low temperatures, the diesel fuel commonly used in compression ignition or diesel engines suffers by precipitation of wax normally held in solution. This causes the fuel to take  
15 on a milky appearance. Of course at lower temperatures still, this actually freezes but before that happens, the fuel will not feed easily to the engine, with the result that it will not continue to run. Temperatures at which this phenomenon becomes  
20 apparent are around -9°C.

Similar conditions may apply in other liquid fuels at varying temperatures. Furthermore the wax content varies in diesel fuel used in different areas.

It has been observed that while fuel in this milky  
25 state will pass fairly readily through pipes, it will not pass through a normal fuel filter, where there occurs a build up of wax, which blocks the passages through the filter element and this is the principle cause of stopping of engines of the compression  
30 ignition type, using fuel of this kind.

Problems also arise in cold conditions of thickening of fuels and oils when in storage areas such as fuel tanks and engine sumps.

It is therefore the object of this invention to  
35 provide means for counteracting the effects of low temperatures on liquids such as build up of wax or other non liquid or semi liquid material, which is precipitated out of the liquid fuel in cold conditions in the filter or in similar parts of a fuel system for an  
40 internal combustion engine, or for keeping a body of liquid warm.

According to the present invention there is provided means for counteracting the effects of low temperatures on liquids comprising heating means  
45 for warming a container in which the liquid is contained, said heating means including a base with an electrical circuit printed thereon, means being provided for securing the heating means to said container, in use.

50 The invention will now be described by way of example with reference to the accompanying drawings in which;

*Figure 1* is a perspective view of a heating means in accordance with the invention; and

55 *Figure 2* is a view of a fuel filter to which is fitted a heating means in accordance with the invention.

Figure 2 shows a fuel filter of the kind commonly used in a fuel supply system for a compression ignition type engine and in which there is a top body  
60 part 10 having an apertured flange 11 for securing by bolts to a suitable structure. This body part 10 has an inlet and an outlet adaptor 12, 13 for entry and discharge of liquid fuel. At the bottom of the filter is a glass bowl 14. Between the body part 10 and the  
65 bowl 14 is a removable filter element which is

contained in a cylindrical casing 15. The filter element in its casing is periodically replaced in service when it becomes dirty. A central bolt 16 passes through the filter element central bore and  
70 engages a nut 17 to hold the parts together. Seals are provided between the respective parts.

Within its casing the filter element is a paper or other element which has small passages for passage of the fuel. The inlet 12 communicates through a  
75 passage in the top body part 10 with the bore through the centre of the filter element, and thence to the interior of the bowl 11.

From the bowl the fuel flows upwardly through the filter element and into the interior of the top body  
80 part 10 and then through the outlet 13. Whilst this is one form of fuel filter it is to be understood that many other types are available but all include a filter element which in cold weather conditions tends to become choked with wax which precipitates out of the liquid fuel.

To overcome the problem of choking of the filter from this cause there is provided a heating means which in this example surrounds the removable filter element part of the filter. This heating means  
90 comprises a flexible base 19 on which is printed an electrical resistance heater. As seen in Figure 1, the heater is in two sections 20, 21. These are so arranged that they are of the same length and therefore of the same resistance value. Both are  
95 connected at one end to a common terminal 22 marked C. Respective terminals 23, 24, marked A and B, are provided at the opposite ends of each heater section 20, 21. External connection to the terminals 22, 23, 24 enables either or both of the heater  
100 sections to be energised. In this example the heater can be used with 12 or 24 volt supply and by suitable connection different wattages are provided.

Connection of one section from terminal C to terminal A or B gives 20 watts for 12 volt supply and for 24 volt supply. Connection of both sections in series gives 10 watts for 12 volt supply and 40 watts for 24 volt supply. If the sections are connected in parallel the 12 volt supply provides 40 watts and it is too high for adequate heat dissipation when connected to a 24 volt supply. The printed material is metallic and is covered with a layer of insulating material which may be transparent. The heating means is in the form of an elongated strip with the three terminals 22, 23, 24 arranged side by side at  
115 one end.

In this example the heating means is secured in place by a pair of flexible straps 25, 26 but any other form of attachment for fitting the heating means closely around the filter element casing can be used.  
120 The heating means external insulation is not sufficient to prevent some heat loss outwardly of the heating means but this, tends to regulate the heating effect on the filter element by preventing too high a temperature being reached.

The wiring may be connected to a switch having positions enabling either or both of the elements to be energised. Timing switches and possibly thermostatic switches may be incorporated to bring the device into operation automatically. A temperature  
130 regulating thermostat may not be needed but may

be used in some installations.

In another alternative construction the fuel is heated before it reaches the filter for example by wrapping a printed circuit heating means around the pipe or other unit through which fuel flows.

The apparatus is suitable for use not only in vehicles but also in stationery plant such as earth moving equipment, concrete mixers or turbines and it is applicable where fuels other than diesel fuel are used where similar problems are encountered in cold conditions.

The heating means may be applied to a fuel tank or engine sump or other container for liquid. Where applied to a large surface to which it cannot conveniently be wrapped and strapped in place, it may be secured by means of an epoxy or other adhesive. Where used on an engine oil sump the adhesive material chosen is capable of resisting high temperatures. In such an application the power to energise the heater sections is preferably external, being provided, for example from the mains supply through a battery charger or the like. A time switch would also be desirable to bring the device into operation at an appropriate interval before starting the engine.

The heating means may be used on other liquid containers to warm the liquid contents to appropriate temperatures.

### 30 CLAIMS

1. Means for counteracting the effects of low temperatures on liquids comprising heating means for warming a container in which the liquid is contained, said heating means including a base with an electrical printed circuit resistance heater thereon, means being provided for securing the heating means to said container, in use.

2. Means as claimed in claim 1 in which the resistance heater has two heating sections arranged on the base and of different length so that independent differing heating effect can be produced by the sections respectively.

3. Means as claimed in claim 1 or claim 2 in which the heating means comprises an elongated base with external electrical connections to the resistance heater at one end thereof.

4. Means as claimed in any one of the preceding claims wherein the means for securing the heating means comprises flexible straps whereby the heating means can be wrapped and secured around a container.

5. Means as claimed in any one of claims 1 to 3 wherein the means for securing the heating means comprises adhesive whereby the heating means can be fixed to a surface of a container.

6. Heating means for use as means for counteracting the effects of low temperatures on liquids comprising a base with an electrical circuit printer thereon.

7. Means for counteracting the effects of low temperatures on liquids substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

8. Heating means as hereinbefore described with

reference to and as shown in the accompanying drawings.

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